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THE MUSHROOM GROWERS'
ASSOCIATION

MGA
BULLETIN

JANUARY 1960 · NUMBER 121

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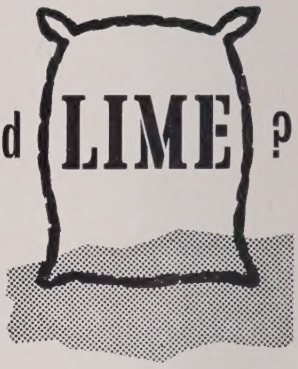

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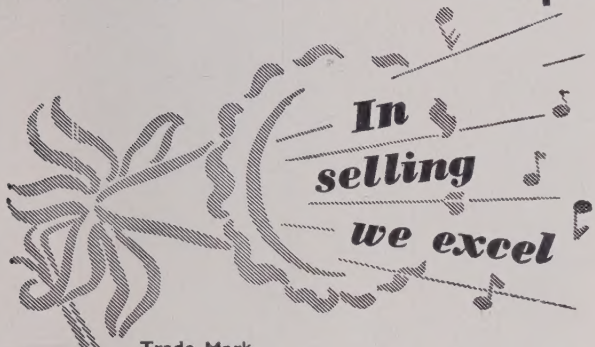

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The **MGA BULLETIN**

JAN. - 1960
NUMBER 121

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EDITORIAL

THE TOAST IS——YOU

It could easily be that the year just past has been the most momentous in the history of the MGA with, perhaps, the possible exception of 1946, the year in which this Association was formed.

Apart from being a record year as far as mushroom production is concerned it was also a record year from a membership point of view. Even more important perhaps, it was a year in which some positive steps were taken in a number of directions.

There was that step taken towards more orderly contributions towards the Publicity Fund, a step slightly arbitrary perhaps but undoubtedly in the right direction, ensuring the growers large and small contributed on a fair and equal basis. The year saw the first positive step taken in an effort to achieve equality with other sections of the horticultural industry in the matter of fertiliser subsidies in that a direct and strong approach has been made to the Ministry. Then too, and again towards the end of the year, came the Government's scheme for Grant Aid to Horticulture, the draft proposals for which left mushroom growers completely in the cold. In fact this industry, growing daily in importance, was not even mentioned! Without this organisation it is probable the industry would have been completely forgotten. As it was, swift action was taken through the NFU, whose services are and always have been quite invaluable to this Association, with the result that at least we are in with a reasonable chance.

On then to the Bulk Oil Scheme, successfully launched in the middle of the year, rather against the odds some say, and now a lusty offspring saving fuel-oil using members about £12,000 a year.

There is much else that could be mentioned. Much good has been said about us and there has been some criticism but, by and large 1959 was a good year although prices, all important of course but over which the MGA as an Association has no control, again dropped. But viewed objectively and bearing in mind also that 4 lb. per sq. ft. remains as elusive as ever, there were many instances of the well-being of the

Editorial—*contd.*

MGA and little or any of the progress made would have been possible without the loyalty, co-operation and understanding, of the rank and file of the members.

Let all of us hope that, in the years that lie ahead, more and more progress will be made, real progress in the fields of production, handling, recognition and administration, progress which will benefit small and large grower alike.

The toast from me to you then is quite simple—it is " To You ".

WRA

EXECUTIVE COMMITTEE ELECTIONS 1960

Following a decision taken by members at the 1957 Annual General Meeting, voting in the 1960 elections for the five vacancies on the Executive Committee will be by post. Of these vacancies, three concern Area Seats and two General Seats. This system of representation was also agreed three years ago.

Although this effort to persuade all United Kingdom Grower Members to take a keener interest in these elections has so far met with extremely poor response, it is being continued for the present in the hope that the 1960 elections will provoke a much larger response.

The five retiring members this year are:—**Messrs. Stanley-Evans** (Surrey), the present Vice-Chairman of the Executive; **Mr. A. J. Berry** (Middlesex), Chairman of the Publicity Sub-Committee; **Mr. Stewart-Wood,** a former Executive Committee Chairman who lives in Berkshire; also **Mr. Guy Reed** (Surrey) and **Mr. N. R. Cooper** (Warwicks.). Mr. Reed and Mr. Cooper have completed six consecutive years on the Committee and are thus not eligible for re-election this year. **Mr. Stanley-Evans** and **Mr. Berry** offer themselves for further service.

Area Seats. There are three Area Seat vacancies and the area concerned is A (see Bulletin No. 87, pp. 99), which includes only the counties of Kent, Surrey, Sussex, London and Middlesex. Thus both Mr. Stanley-Evans and Mr. Berry are eligible for nomination for either an area or a general seat but Mr. Stewart-Wood may only be nominated for a general seat. **Only Grower Members within the area concerned may vote, nominate or be nominated, and members should ascertain,** if possible, if the candidate they nominate is willing to stand. Members will be notified by letter of the procedure to be followed, and such notification will be in the hands of members on or before 27th January.

General Seats. Nominations for the two vacancies must be received not later than 24th February, on the forms to be provided and again members are asked to make sure that the member nominated is willing to stand.

The complete Membership List appeared in the December, 1959, issue of the *MGA Bulletin* (No. 121). United Kingdom members listed in italics are **not** eligible for service on the Executive Committee. A full list of present Executive Committee members appears above the Editorial in this issue. As Hon. Treasurer, Mr. Filmer has a permanent seat on the committee.

IN-DIGEST-IBLE

by STANLEY MIDDLEBROOK

The World has lost its DIGEST and demands more food of a similar kind from a new source, according to the Editor. Well, believe it or not, I have been told to fill that gap with S.M. cracks. But the World must go hungry because any dishes I've ever " cooked " have always been unpalatable and highly indigestible. The World writer has let us down and the Editor invites trouble for himself when he forces me to feed you a few rock buns.

A great deal has happened since the last PINHEAD grew, wilted and browned off.

For one thing time and misfortune have taken their toll. In two years I have lost a lot of hair through loss of crop (mushroom). I have lost a lot of friends, first through lack of contact following the demise of PINHEADS, and second because of a certain amount of non-co-operation on my part in matters which are unmentionable here. Though I may not be alone in personal misfortune I am left very much alone by the misfortune of others, inasmuch as I am now the last surviving *grower* member of the original team that started the MGA. A sobering thought. Note I said *grower* member. There's an odd Life member extant somewhere, known to us all as . . . . . but advertising is not allowed.

Yet even this unenviable state of loneliness was almost rendered untenable by the scandalous, wicked, and grossly immoral compulsory membership levy. Almost alone I opposed it and only avoided dismissal and the wilderness by abjectly submitting to the Secretary's unwarrantable " Dear Stanley, Unless . . . . . "

I value membership of the MGA more than my principles. How low can one sink?

Misfortune can't last for ever, and some things have changed for the better. For instance, Brown disease and its near relative La France, have apparently disappeared as a powerful force for evil. In my view our present freedom is thanks to no one. Their disappearance is no more understood than was their appearance and I hope no one is taking any credit for knowledge that simply doesn't exist.

In this same connection I believe there has been a whole lot of irresponsible and erroneous thinking by those who have linked Watery Stipe with the above diseases. La Franced and Browned mushrooms were seen to possess this watery streak feature and the inference was drawn that it was never there before. In fact it had never been looked for before! At the present moment when for many months we have seen no sign of either of the two diseases we can find watery stipes in perfectly healthy mushrooms, water streaks in the caps too. I have yet to find anyone who will swear there were never watery streaks to be seen in mushrooms before the La France/Brown era. Is there any justification for supposing that Watery Stipe is either a disease in its own right or in any way connected with La France or Browns?

I'm full of admiration for those growers who can handle the new hard-walled straws and make as good a compost as ever without changing their method or composting time. I confess to being totally unable to prepare a compost in 7—10 days. Composting time is stretching to 18 days, 20 days, and even longer before anything like a desirable end product is reached. Our composting is now all outside and pretty well mechanised. As a check we've just tried a stack by our old well proved DLP hand turned method under cover. Two hard packed square turns followed by several days in light small aerobic triangles—a total of 13 days. For years this gave remarkably consistent and satisfactory end points. But now? At the 13th day this very carefully handled compost was just about ready . . . . . to start composting! These stiff, multi-walled straws remain green and apparently unaffected by heat and bacterial activity for a very long time, and this despite a vast variety of experimenting with different kinds and quantities of supplements, different amounts of water, air, stack compression, different numbers of turns, intervals between turns, and anything else we could think of to give a possible lead.

It seems to us as though only time will permit the straws to become soft and broken down.

Stay . . . . . stop . . . . . hold it! I've just heard of a grower who's cut out composting altogether. He fills well-wetted fresh manure into the house and peak heats it for a day or two longer than usual. Report says his crops are as good as with normal composting. I tried this way back in the mid Forties with not very satisfactory results. Italian prisoners were the only men who would water the compost during peak heating.

If this grower is right it doesn't seem to matter too much about getting rid of the green before filling. Interesting. See next item.

In spite of our difficulties in handling these new hard straws, or more likely because of them, there is one profound fact which has emerged from our two years of depression. Only one thing matters in mushroom growing—COMPOST. Spawn, casing material, watering, ventilation, temperature, humidity, and anything else you can think of . . . . . these are nothing compared with compost. Paying the barest attention to any of these items any fool can get a reasonably good crop from a first-class compost, but the most efficient application of every one of those items under the most able and expert management will avail nothing with a poor compost. I'll stand up to anybody on that. A really good compost has a terrific tolerance and nothing short of disease or pest or sheer tom-fool management can stop it producing. If that statement sounds wild let me modify it by saying that if we're looking for a crop improvement of anything like 1 lb. or more per sq. ft. we must look for it in compost, whereas application of the other items by themselves might give a gain or loss of no more than $\frac{3}{4}$ lb. at most. In other words if you're producing a steady 2 lb. you might hope to raise it by as much as $\frac{3}{4}$ by these other-than-compost items. But if this 2 lb. suddenly falls to 1 lb. or below you can bet it's compost and nothing to do with the other things.

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If you want to shoot me up on this, think what this no-composting chappie's doing and consider the following: It's not what you do with a compost that matters, but what's in it to start with.

I agree, it's all very confusing.

In the early part of last year a learned man came up to improve our cropping. We spent money on his scheme for better air movement in our houses. He saw the first installation, metered the movement and pronounced himself satisfied that crops would immediately improve beyond measure. Results were no better than before, but there *was* a marked improvement when we turned his scheme inside out and reversed everything. So much for meters!

We are witnessing the thin end of the spawn-factory-craze wedge. One could perhaps view the situation best from outside the industry, in fact most of us may soon be able to do so! To the layman it must be pretty obvious that there are two important factors triggering off this craze. First, the temptation to make indisputably high profits from the sale of spawn to timorous, gullible and totally dependent mushroom growers must seemingly be too great to resist. Second, the excessive demand for spawn created by the disastrously high rate of increase of growing area is the strongest possible inducement to get on the spawn wagon and invest in the safest bet in the little time left before over-production of mushrooms throws us back to our beginnings.

But even spawn producers can have a heart. My maker, with whom I've crossed swords too many times to remember, has adopted a very pleasant and avuncular attitude. Jocularly classifying us as guinea pigs he has plugged us many samples of new spawns. These have been mostly free (in consideration of our two years' struggle?) but one recent lot was charged to us (mistakenly I believe). I did the natural thing and hurled the account into the waste basket and—well—Bob's your uncle!

Mention of over-production reminds me that our Chairman hit the nail on the head in the November leader. Viewed from our rough and uncouth North it was a gentlemanly, well-mannered, polished, cultured and graceful exposition and the aim was deadly accurate. It's a pity Raymond used a rubber-headed hammer.

Look out for a 14 pounder shortly. I may miss the nail, and somebody's thumb might get in the way, but something drastic has to be said and done about this over-production menace.

1960 ANNUAL GENERAL MEETING

CHANGE OF VENUE.

All members are asked to note that the Annual Lunch and Annual General Meeting of the MGA will take place on Tuesday, 22nd March at The Connaught Rooms, Great Queen Street, Kingsway, London (nearest Underground Station—Holborn) and not, as stated last month, at Simpson's Restaurant in The Strand.

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1959 in RETROSPECT

We mushroom growers, so badly unnerved
By the Belgian Disaster, hardly observed
Amid daily news of that fated mine,
The silent approach of '59.
In direct contrast to news so grievous,
We had just welcomed, a few weeks previous,
The solution to our over-production fiasco,
Publicity Relations Officer—Miss Pasco.
And now Miss Baker is doing a lot
To help us sell the buttons we've got;
We hope she'll proceed to convince many more
To unloose their buttons for Mushrooms Galore!
It's about '59 this Calypso's to do,
So let's recap and trace it right through;
Only once in history ('twas nine years ago),
Were Springtime prices ever so low;
To quote R. L. Edwards—a man of knowing—
" One of the worst Summers for mushroom growing",
And our Summer was shared by Dane and German,
" Rotten Summer prices" to quote our Chairman.
'59 was a year to remember,
Especially from July till nearly November.
The atmosphere, for months on end,
Was moisture laden (as cells distend)
And releasing its load—one of its faults—
It over-wet casing with disastrous results,
As down to the compost did the water seep—
The whole blooming business—'a warm-air weep'.
Or, will '59 be labelled the year
That Major Dredge was Britain's Top Skier,
That the Fuel Oil Scheme made its debut,
That war raged over Boletus Edu'?
(The soup-powder wording has since been changed:
P.S. Printers—Soup, not soap, or we'll be estranged).
Or, will '59 be buried in a box,
Bearing a label—'Leave longer stalks'?
Or, the following epitaph, on its grave-plot lawn,
That publicity pigeons fed on grain spawn
Were supposedly given special permission,
To fly to Hyde Park on a fruitless mission? F.P.

DEATH OF Mr. C. P. CHAMBERLAIN

We regret to record the death of Mr. C. P. Chamberlain of Trowbridge, Wiltshire, who had been associated with the mushroom industry for many years and who, for some years had judged the MGA mushroom competitions. During the early years of the MGA he served on the Executive Committee. A message of sympathy and a wreath for the funeral were sent by the MGA.

LAST MONTH'S PUBLICITY CONTRIBUTIONS

***Spawn Merchants:—**

Monlough Food Production Co. Ltd., Ballygowan, Belfast.
S. A. F. Sampson Ltd., Oving, Chichester, Sussex.

*Amounts collected by spawn merchants are not for publication.

Specially translated for the MGA

PIG MANURE COMPOST AS A CULTURE MEDIUM FOR MUSHROOM GROWING

C. RIBER RASMUSSEN
Director of Mushroom Research, Copenhagen

Some years ago the Danish Mushroom Research Laboratory began investigations with pig manure as a possible medium for mushroom growing. We are still far from having got to the root of the problems and all the relevant factors bearing on this particular culture medium, but we have grounds for supposing that in the future pig manure will be of decisive importance.

Introduction:—

Before the beginning of this century, it was thought that the only suitable culture medium for mushroom growing was horse manure. In this century a number of investigators have worked with so-called synthetic composts, in which, together with some form or other of straw (often wheat straw as a basis) or hay or maize waste—or these materials in a mixture—as well as various organic or inorganic substances have been included.

As a result of investigations undertaken by Lambert (1929), Demelon (1935), Sinden (1938), [and] Stoller (1943), who each worked with a so-called synthetic formula, satisfactory [literally: acceptable] yields were recorded. In U.S.A. large quantities of synthetic compost are used *inter alia*, of which the formula is based mainly on Sinden's work and in which hay, crushed maize cobs with wheat straw are introduced as well as a number of inorganic chemical substances. A yield of 8-11 kg. per m^2 of the area of the beds is obtained. The latest synthetic formula was the result of Dr. R. L. Edwards's research at the Mushroom Research Station then established at Yaxley in England. This synthetic compost, called MRA, is being used in England by a number of growers with astonishingly good results. Some growers obtain a yield of 10-12 kg. per m^2, and this with up to four crops per year per room.

At the Mushroom Laboratory of the Agricultural College experiments have been conducted for 6 years with both synthetic and horse manure compost.

The following results were obtained in 2 yield trials in which the above-mentioned MRA compost and horse manure compost (prepared by the method of composting and pasteurizing evolved by the Mushroom Laboratory i.e., 16 days outdoor composting, with the addition of certain chemical substances and with 48-60 hours pasteurization at

57-59°C.) were compared and in which, moreover, synthetic Brewers' grain compost was included:—

Table 1. Yield Trial

kg/m² in 90 picking days

	Horse manure "normal" = 50%	MRA	Brewers' Grain compost
1st experiment	22.2	16.2	13.1
2nd „	18.6	11.3	11.3

Even though quite remarkable yields have been obtained on the MRA compost and, in fact, a higher yield than was normally obtained at that time (1953) even with horse manure compost, and even though the brewers' grain synthetic similarly gave good yields, nevertheless the table shows clearly that the Mushroom Laboratory's horse manure compost gave a considerably higher yield. In comparison with the MRA compost, an increase in yield of as much as 70% was observed.

Apart from the lower yield when the synthetic composts are used and the fact that synthetic compost has various advantages, the cost of production of MRA compost, for Denmark at any rate, is considerably higher compared with the price of horse manure, especially since the synthetic compost requires large quantities of blood-meal (which is normally used for live-stock feeding), which is dear to purchase. (With reference to synthetic compost, in general, see the 3rd, 4th and 5th Reports of the Mushroom Laboratory).

The effect of the amount of blood-meal used in Brewers' Grain compost was investigated in two comparative series of experiments with MRA compost and horse manure compost. The amounts of blood-meal used were calculated as a percentage fraction of the amounts that are normally added to MRA compost. Table 2 shows the results obtained:—

Table 2. Yield

kg/m² in 90 picking days

	Brewers' grain compost 0% N.	Brewers' grain compost 25% N.	Brewers' grain compost 50% N	MRA 100% N.	Horse manure "normal" = 75%
3rd Experiment	8.8	13.9	13.6	11.7	19.0
4th „	9.9	9.8	14.3	15.1	26.3

The experiments show clearly that blood-meal is very important if one wishes to obtain satisfactory yields, and once again that none of the synthetic composts could produce such high yields as the Mushroom Laboratory's horse manure compost.

In 1954, some preliminary experiments were begun with pig manure compost as a substitute for horse manure. The first results were, however, discouraging and the average crop for the normal 90 picking days was only 3.4 kg. per m^2. The chief cause of this [result] must doubtless be sought first and foremost in the unsuitability of fresh pig manure and in the lack of experience in carrying out the work of fermentation and pasteurization. An improvement took place in the next experiment, and, probably, particularly because the choice of the fresh pig manure had been more fortunate. In the 5th and 6th series of experiments yields on pig manure compost were recorded which were on a level with [those from] the Mushroom Laboratory's horse manure compost and in a few cases even exceeded [the yield from] the latter.

In the 8th series of experiments, which was concluded in November, 1958, (using the same strain) a difference in yield of over 7 kg. per m^2 was obtained with the best pig manure compost treatment, as compared with horse manure, i.e., a percentage increase of over 50% in favour of pig manure.

The use of pig manure as a substitute for horse manure does not commend itself to mushroom growers and naturally it has no attraction whatever for the users. This latter point was made quite clear on one occasion in connexion with a television broadcast in which pig manure was mentioned as an excellent culture medium for mushrooms. It must, however, be stated at once that if the fresh pig manure looks very unpleasant, that is to say with too little straw and therefore greasy and evil-smelling, it is the experience of the Mushroom Laboratory and now also of the practical mushroom-grower that it is relatively ill-suited for use as a nutritive medium, at any rate with our present knowledge of [the use of] pig manure.

Already, however, there appears to be some ground for supposing that the nutritive value of pig manure for mushrooms, provided the right method of treatment is used, probably far surpasses [that of] horse manure. It must, however, be mentioned at once that, in the experiments with pig manure which were carried out by the Mushroom Laboratory, the compost after fermentation out-of-doors had not the characteristics which are normally attained with a good horse manure compost (namely, uniformity, with a good structure and a pleasant odour), and in absolutely no case was it anticipated that the pig manure compost could attain the yields which the individual series of experiments have revealed.

Observations on the quality of fresh pig manure

As already mentioned, *prima facie*, the choice of the fresh pig manure plays an important role. For the initial experiments of the

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Mushroom Laboratory manure was used from a pig farm where mainly hotel and kitchen refuse had been used as fodder. At the same time only very small quantities of straw had been used for litter, with the result that the manure looked very unpleasant and, moreover, contained many fragments of bone. This, in conjunction with ignorance regarding fermentation of pig manure, led to some remarkable results. In the first place, immediately after the first turning, a very large number of maggots emerged which apparently came from the bones and bone fragments—and this occurred in spite of the fact that the hotel and kitchen refuse was boiled before being used as fodder. Even though, as compared with horse manure, only quite small quantities of water were added, a very high temperature developed in the heaps (over 80° C.). Astonishingly little burning however took place and the manure remained at all turnings tough, greasy, caked and unpleasant. Nevertheless it could only be described as unusually short when being laid. Even after pasteurization, the compost had not improved to any marked extent. In addition, one must add that after laying, the compost still contained so much energy that the temperature during pasteurization—and with a normal air temperature—rose rapidly to 73-74°, without there being any possibility of bringing it down. In spite of this, the high temperature did not lead to the occurrence of *Chaetomium* as one might naturally have expected. After spawning the mycelium ran rather slowly, but had grown well into the compost after 21 days. The ultimate yield was, however, very low as compared with horse manure (cf. Table 3). It should be mentioned that in the second picking-month a very severe attack of mite occurred in these pig manure beds: the mite was *Pigmæophorus americanus*, the small red mite which collects in large numbers on the cap. In general, this mite causes no direct damage, apart from the fact that it is unpleasant for the pickers; but the remarkable fact was that only the pig manure beds were attacked, while the neighbouring beds (with normal horse manure) were not once attacked by the mite during the whole cropping period even though the whole experiment had been cased with the same type of soil. The explanation must doubtless be sought in the composting and pasteurization, the high temperature having possibly liberated a nutritive substance which the mites in question require for their existence and which is not normally found in horse manure. The experiment shows clearly that pig manure differs in several features from horse manure.

In the light of the experience gained, fresh pig manure was used in the following experiment, in which the Mushroom Laboratory itself had determined and supplied the quantities of wheat straw for litter. The aim was to use the amount of wheat straw that is normally used in riding and trotting stables. The pigs were fed in the normal way with skim milk, grain, etc., and not with hotel and kitchen refuse. Thus the fresh pig manure somewhat resembled fresh, horse manure. The compost, when ready for use, had a rather agreeable appearance, and good yields were obtained (cf. Table 3, Experiment 3).

On the basis of this experiment and subsequent ones, we can (until we acquire more knowledge) make the following observations regarding

Table 3. Yield
kg./m² in 90 picking days

	Horse manure " normal " +50%	Horse manure " normal " +75%	Pig manure without supplement	Pig manure " normal " (1)*	Pig manure " normal " +75%
1954 1st Expt.	22.2			3.4	
1955 2nd „	18.6			14.8	
1955 3rd „		19.0		16.2	
1956 4th „		26.3		20.6	
1956 5th „		21.9	23.1		15.6
1957 6th „		18.7	18.4	17.2	18.9

(1)*Normal supplement per ton of fresh horse manure
4 kg. ammonium sulphate on stacking.
15 kg. feed lime at first turn.
4 kg. superphosphate and
15 kg. gypsum at 2nd turn.

the quality of fresh pig manure: kitchen and hotel refuse or similar matter must obviously not be used as fodder. For litter, wheat straw should be used, and in the same amounts as for horse manure. In all cases it is certain that it is undoubtedly advantageous to use enough straw to ensure that the moisture content of the fresh pig manure does not exceed 50%. Certain circumstances suggest that one may, perhaps, use even larger amounts, but this has not been experimentally proved. We may mention incidentally that, even with large amounts of straw, the fresh manure is considerably shorter than horse manure. Similarly, the Laboratory has also found that the fresh manure, if a storage period should happen to be necessary, must be protected from rain and, moreover, storage should be as short as possible. The point is that, if one starts with a moisture content that is too high (over 50%), there will be no opportunity of adding water artificially later on. From the purely practical standpoint, this might possibly sound attractive, but the problem *does* arise, because pig manure contains large quantities of energy—and if it has only its own natural moisture content to work on, unequal combustion occurs, since the moisture varies from place to place. As a result of this, the compost already at the stage of the first turning contains many small dry lumps. If one attempts then to add water where these small patches have been formed, the usual result is merely that the dry patches get too little water and the surrounding manure gets too much. The final result is that the finished compost is greasier than it need be. On the other hand, if one begins with a relatively dry compost (not " fire-fang "), then water must be added

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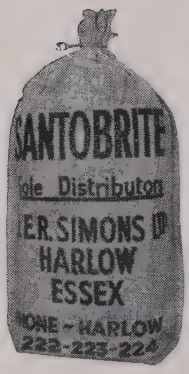

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when stacking — which results in a better distribution in the heaps during the slightly slower rise in temperature and fewer dry patches are formed and a more uniform compost is obtained. In general, however, it must be stated that it is more difficult to distribute water in pig manure than in horse manure.

Composting Schedules

In the first 6 series of experiments with pig manure the Laboratory employed the 16 day composting period normally used for horse manure according to the scheme 0/6/10/13/15/16, which means that the fresh manure was stacked on day 0, on the 6th day the first turning was carried out, on the 10th day the second, and on the 13th day the third. Shake-up is usually done on the 15th day after stacking and on the 16th day the compost is laid.

In the two subsequent series of experiments, in addition to the above scheme, one based on 0/4/7/10 was also used. The heaps were similarly stacked on day 0, while the 1st and 2nd turnings took place on the 4th and the 7th day respectively after stacking. Shake-up took place on the 9th day and the laying of the compost followed on the 10th day. In addition, a decidedly short composting plan was adopted in accordance with the scheme 0/2/4/6/7, with stacking on day 0, but with first and second turnings on the 2nd and the 4th day respectively, shake-up on the 6th day and laying on the following day [day 7].

Stacking

Normally, fresh horse manure is stacked in heaps 160 cm. wide and 120-140 cm. high. In stacking, the heaps are gradually well trampled down and at the same time large quantities of water are added. This is very important in order to make the manure uniform and to make the straw take up sufficient water for optimum fermentation.

With pig manure the technique is somewhat different and only very small quantities of water are employed. Table 4 shows the quantities added to pig manure in a series of experiments, and, for purposes of comparison, the quantities that are used for horse manure are shown. In addition, the moisture content of both types of manure on stacking and laying and after pasteurization is shown.

From this [table] it is evident that pig manure had only received 5-20% of the quantities [of water] that were used for horse manure, although both types, on stacking, started with the same moisture content on the whole. The table also shows that the percentage of water on laying is approximately the same for both composts, which one would not have naturally expected in view of the great difference in the amount of water that is used in composting.

These figures show very clearly that the fermentation processes in pig manure are very different as compared with horse manure. Many investigations must, however, still be carried out—both chemical and microbiological—in order to acquire more knowledge of the difference between the two types of manure.

In view of the natural shortness and greasiness of pig manure and the fact that the manure rapidly heats up, it is important not to make the heaps too broad when stacking nor to make them too high. In the experiments only heaps 130-140 cm. in breadth and about 120 cm. high were used. These were not trampled, but only lightly flattened by beating with the back of the fork. In addition, we tried to build up the heaps as loosely as possible. Adequate admission of air seems to be highly important. If the heaps are made too high and broad, anaerobic fermentation and low temperatures rapidly ensue. With proper stacking and the right amount of water very satisfactory fermentation can be attained and a high temperature—up to 80°—may be recorded. We may mention that pig manure in all cases has a marked tendency to settle (especially between stacking and the first turning), which tends to prevent satisfactory aeration and leads to a fall in temperature.

The greatest difference between pig manure and horse manure consists (as already stated) in the astonishingly small quantities of water that pig manure requires. Too large quantities of water naturally exclude the air still more; the finished compost becomes too greasy and has an unpleasant appearance, and is more or less unsuitable as a nutritive medium for the mushroom mycelium. Judging the correct amount of water needed for pig manure calls for great care and some practice.

The first turning

At the first turning, only a small " fire-fang " zone is to be seen as a rule. In the most central and lowest part [of the heap] there is often a central cross-section of yellow compost that has undergone anaerobic fermentation—but usually the rest of the heap is well fermented and as a rule considerably darker in colour than horse manure at the same stage. The smell is far from agreeable and the top layer of the heap is usually very slimy and sticky owing to condensation. In order to prevent this layer from becoming the lowest in the new heap, the top 20 cm. are removed, laid aside and subsequently mixed gradually into the new heap. Before beginning the turn, enough manure is taken from the good areas, i.e., the " fire-fang " zones, to form the first 20 cm. of the bottom layer of the new heap. Sufficient of this manure is laid aside, in fact, that the heap, when completed, can be covered over with a layer about 20 cm. deep of well fermented manure. This procedure was followed moreover at all turnings. At the first and later turnings, the heap is kept about 135 cm. wide, while retaining the normal height.

At the first turning, any water that may be needed is added, but it is a question (as stated) of only very little. One must exercise the greatest caution. At the first turning the pH is high (8.2—8.5). The compost smells strongly of ammonia and it has still the typical smell of pig manure. The individual straws are very greasy and difficult to break, even though the manure is already very short.

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Table 4

1. Amounts of water in litres during out-door composting per ton of fresh manure.
11. % moisture on stacking, on laying and after peak-heating.

Experiment No.	I.							
	3		4		5		6	
Compost type ..	Pig Manure	Horse Manure	Pig Manure	Horse Manure	Pig Manure	Horse Manure	Pig Manure	Horse Manure
On stacking ..	67	450	104	603	14	585	42	617
1st turn	25	60	61	92	25	100	47	94
2nd „	18	68	56	62	10	19	8	8
3rd „	10	16	8	8	20	8	2	0
At shake-up ..	7	20	0	0	0	0	0	0
TOTAL	118	614	229	765	44	712	99	719
	11.							
% moisture on stacking	64	55	55	54	60	58	52	51
% moisture on laying	66	67	66	69	69	68	68	69
% moisture after peak-heating	66	66	?	?	64	62	?	?

2nd Turning

Between the first and second turning a small narrow " fire-fang " zone is also usually formed, but it is extremely rare to find anaerobic manure. The colour has become still darker. If one has been unlucky with the watering, because one has used fresh, pig manure with a too high moisture content and therefore had to carry out discreet watering in patches, many light coloured and inadequately fermented straws are often to be seen. The unpleasant smell is growing less at this turning, but the compost has an odour which cannot be said to be identical with horse manure compost at the second turn. The straws are considerably easier to break, but, as compared with horse manure, still tough and greasy.

3rd Turning

At the third turning, if all has gone well, pig manure compost is a good deal like horse manure. It is naturally considerably shorter, but it has an acceptable structure. " Fire-fang " formation often occurs across the whole width of the heap; the typical smell of pig manure has almost disappeared; and the manure has now become also quite friable.

At Shake-up

On the 15th day after stacking, the compost is given its shake-up. The most characteristic feature is the predominant greasiness. Even in the treatments in which the chemical substances normally added to horse manure were used, marked greasiness was constantly observed. In general, one can say that pig manure compost, as compared with horse manure, is not so uniform and often a large number of light-coloured straws can be observed. Apart from this, however, and, in particular, as compared with the first turning, the final product may be said to be quite good. The [presence of the] numerous light-coloured straws is no doubt connected with the difficulties of adding the proper amounts of water on the numerous light-coloured patches at the first and, to some extent, at the second stacking. In most of the experiments carried out, the smell could be described as good, but different from horse manure compost. As already stated, one would not have supposed that pig manure compost could have given a yield equal to that from horse manure or, as was the case in several experiments, could have even exceeded it.

Laying

Sixteen days after stacking the compost was laid down. The pH figures in the treatments in which chemical substances had not been added were very high, often in the neighbourhood of 8. In all the experiments conducted and with the quality of fresh pig manure used, it is clearly seen that pig manure compost loses considerably more dry matter than horse manure compost. With the latter, using the Mushroom Laboratory's method of composting and the addition of chemical supplements, an area of 12—13 square metres of bed-surface can be covered per ton of fresh horse manure, if the finished compost

is laid down at the rate of 80 kg. of compost per square metre of bed-surface—which corresponds to a layer about 18 cm. deep. With pig manure compost we obtained on the average only about 8-9 square metres of bed-surface with 80 kg. of compost per square metre of bed-surface. The cause of this has not yet been elucidated and requires further investigation. It merely shows that pig manure in this respect too is different from horse manure—another circumstance which must be taken into consideration when the price to be paid for the fresh pig manure has to be discussed. Naturally, it is possible that the number of square metres attained per ton of pig manure probably depends largely upon amounts of straw used, but that has not yet been proved experimentally.

In addition, it has been found that a 16-day pig manure compost must not be packed too tightly in the beds, since the greasiness diminishes the degree of pasteurization, so that mycelial growth of the mushroom is reduced and fructification is diminished.

Pasteurization

In all experiments with 16-day compost, the pasteurization technique employed for horse manure compost was used. The pasteurization temperature of 57-59° was obtained partly by using the hot-pipe heating system and partly by blowing in " live " steam. As a rule 15-20 hours elapse before the desired temperature is reached and pasteurization is terminated after 55-70 hours. During the process, normal amounts of fresh air are used, corresponding approximately to a temperature difference of 3-4° between air and compost. During pasteurization, as a rule vigorous " fire-fang " formation takes place, which if it is not quite completely developed, continues to be formed during the cooling of the compost. As a rule the moisture content decreases more than in horse manure (cf. Table 4), in spite of the fact that the compost still feels greasy. It must however be strongly emphasised that pasteurization of pig manure compost is of the utmost importance. In experiments without pasteurization, very serious reductions in yield were recorded. Examples were observed in which the mycelium in the course of only a few weeks—in spite of a relatively good run—had totally disappeared, either because of a combination of bacteria and nematodes or from some other cause.

Spawn Run

As already mentioned, spawn run seems to be a little slower than with horse manure compost. Certain circumstances suggest that this is directly due to the formation of an inhibiting substance or simply to the structure of the manure. It must, however, be emphasized that the manure in all experiments was completely permeated with mycelium on casing. It should also be noted that the mycelium may often have rather thin threads and therefore be slightly weak (in its growth) on casing, but the condition in this respect improved considerably during subsequent cropping. One must similarly note that the treatments that received a supplement of chemical substances (even though, purely from the standpoint of yield, they were not particularly outstanding)

always left a vigorous and healthy mycelium behind at the time of emptying. It may be supposed that the mycelium in pig manure compost can develop vegetatively, even when fructification has begun—a phenomenon seldom seen with other types of compost. This problem too calls for further investigation.

Experiments with shorter composting periods

The above mentioned findings were reached with normal 16-day compost, but, in addition, two series of experiments were carried out in which we worked in one case with a 10-day compost and in the other with a 7-day compost. In both experiments a pig manure was used in which more straw was employed than in the earlier experiments and the fresh straw was considerably longer than usual. In spite of this, the manure still looked very heavy and also had a moisture content which was slightly more than desirable.

Stacking and turnings were carried out as already described. After a short time a very high temperature was reached. The 10-day and the 7-day composts looked highly disagreeable and had an unpleasing structure and a very bad odour. The 7-day compost was very tough on shake up and had a pale grey appearance. As compared with the 7-day horse manure compost, both the 10-day and the 7-day pig manure compost must be regarded as an absolutely unsuitable nutritive medium. The 7-day compost had also such a marked content of " free " water that the straws at the time of filling were simply glistening with water. In addition, it was very difficult to press 80 kg. of finished compost into the square-metre beds, which means that the filling capacity was very great and in other respects too, agreed well with the characteristics found in short-composting in general. The greatest difficulty, however, arose during pasteurization. Normally the Laboratory encountered no great difficulties when it was necessary to pasteurize different types of compost. With care, it is possible to adapt the pasteurization process so that any differences in the types of compost used are counteracted.

This could not, however, be done in the series of experiments in question. A few hours after pasteurization began, the temperature rose markedly and beyond control in the 10-day and particularly in the 7-day compost, in psite of the fact that they had been placed on the middle and the lowest shelves in the experimental shed of the Laboratory, while the 16-day compost was situated on the topmost shelf. Even though the 16-day **horse manure compost** had risen to only 40° after 12 hours, already at this time over 60° were recorded in both the 10-day and the 7-day compost. Strong ventilation was tried which unfortunately led to a further rise of temperature in the composts mentioned—apparently owing to the large quantities of oxygen having given additional impetus to the process of (fermentation). Even the 16-day pig manure compost was very difficult to control and for a long time showed a temperature of 61-62°. Only after 6-7 hours of cooling was it possible to bring the temperature down to about 56°. With great patience, we succeeded in making the temperature in the horse manure compost in the same shed rise, without any effect worth mentioning

upon the pig manure, which at this juncture had apparently used up a large part of its energy. In the last 24 hours of pasteurization it was not possible to note any difference between the composts. But damage had already begun as regards the pig manure, even though it could not be detected until 14 days after spawning. Then, there occurred on many of these composts a serious outbreak of ink-cap, an occurrence which, empirically, can be attributed to the 8-10 hours at the high temperature over 61° to 65°. It must, however, be emphasized that, although the highest temperatures were recorded in the 7-day and the 10-day composts, it was not there that the attack was most marked; it was considerably worse in the 16-day compost, in which the temperature had exceeded the temperature limit of 60° for only a few hours, whereas one would have naturally supposed that it would have been the short-term composted treatments (in which the very high temperature for a long time has been recorded) which would have exhibited the most severe attack. The explanation must, without doubt, be sought in the fact that the long-term composted pig manure had become still heavier and that it—owing to the ammonia formed, the greasiness and shortness—was unable to liberate it (i.e., the ammonia); whereas the short-term compostings, in spite of the high temperatures and intense formation of ammonia, were nevertheless able, owing to a more open structure, to liberate the ammonia formed. We must also mention that in these experiments 2 methods of filling were included, namely, the use of 80 kg. of compost per m^2—which is the normal practice—and a treatment in which only 64 kg. per m^2 were used, and, moreover, with the same depth of bed. Here it was clearly demonstrated that the densely filled bed had considerably more ink-caps than the loosely filled beds. There were even treatments with 10-day and 7-day compost, but loosely filled, which showed no ink-caps at all, in spite of the high temperature of up to 65° for 8 to 10 hours—and it was here that the highest yields were obtained. From this one can conclude that the loose structure of the compost is able, in spite of the intense fermentation, to liberate the unwanted ammonia. In addition to the mishap with the pasteurization some of the treatments were attacked by " mummy disease ", which contributed further to the difficulty of assessing the results.

We were, however, able to draw many conclusions, indicating that short composted pig manure had considerable possibilites—which we had not been able to do in earlier experiments at the Mushroom Laboratory (in which short composting of horse manure was compared with the normal 16-day composting). Without entering into the details of the results regarding yield, one may mention that the highest yield was obtained with 7-day compost, which gave 17.1 kg. per m^2, while the lowest yield, 9.9 kg. per m^2, was recorded in the case of a 7-day compost with supplementary chemicals.

On the basis of the experience obtained in this experiment a new series [of experiments] was carried out. The only difference, as compared with the first experiment, was that the 7-day and 10-day composts were laid down 2 days earlier than the 16-day compost. Immediately after laying, the room was shut up and, by means of hot pipes and a

little steam, it was possible in a short time to bring both of the pig manure treatments up to from 50° to 55°. In this way they were given a start so that combustion had proceeded so far in them that, when the normal pasteurization process was started (after the rest of the experiment had been begun), they could easily undergo pasteurization with the other treatments. Without entering into details of the course of pasteurization, it must be mentioned that the long pasteurization time of the 7-day and the 10-day composts (about 2 days) led to the formation of a very vigorous [growth of] " fire-fang ", as a result of which the manure felt very dry. In spite of this, the mycelium ran well and had penetrated all over in the course of 21 days.

The yields, which are given in Table 5 were particularly encouraging. First we may mention that the horse manure (laid down as a control) had given 7.1 kg. less per m^2 with the same strain than the 7-day pig manure compost attained, with the filling based on 80 kg. of compost to the square metre. The latter treatment gave, moreover, the highest yield of the experiment, namely, 20.9 kg. of mushrooms per m^2 for the normal 90 picking-days. In addition, it is interesting to observe that this experiment has given an unusually good result on the whole as regards the use of a deeper layer of compost—up to 3 kg. per m^2 in the case of 10-day compost. This means in other words, that with pig manure compost we have proof that it is the amount of nutrients that, on the whole, determines the size of the crop. According to the table, there is a tendency for the short-composted treatments to be slightly better than the 16-day composts (up to 2 kg. per m^2). Whether there is any real difference is, perhaps, difficult to decide. On the other hand, the short-term composted composts have certain advantages, *inter alia*, less labour is required for composting, and, in addition, the fact that more square metres are obtained per ton of fresh manure, and also the fact that less additional heat is required during pasteurization. Thus if one can, in addition, accustom oneself to laying down a compost that looks unattractive, as compared with what is normally desired and is necessary if one is to obtain yields from horse manure compost, then the experiment demonstrates the possibilities in the use of short-term composted pig manure.

Table 5. Yield

kg./m^2 in 90 picking days

Pig manure 16-day composting		**Pig manure** 10-day composting		**Pig manure** 7-day composting		**Horse manure** 16-day composting
64 kg/m^2	80 kg/m^2	64 kg/m^2	80 kg/m^2	64 kg/m^2	80 kg/m^2	80 kg/m^2
18.1	19.1	16.7	19.7	18.2	20.9	13.8

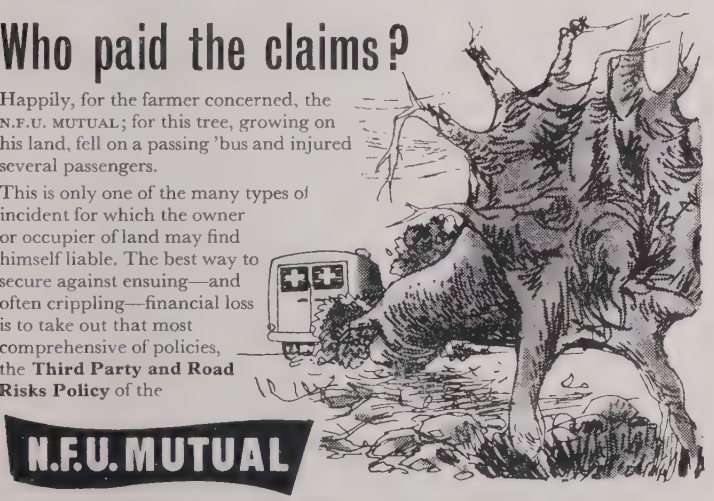
GENERAL OBSERVATIONS

In the course of a long series of experiments, carried out at the Mushroom Laboratory with horse manure compost, it has been established that a considerable increase in yield can be obtained by the use of certain inorganic chemical substances, which are mentioned in Table 3. These chemical substances were also tested in the various pig manure treatments. In general, one can state that the findings provide no support worth mentioning in favour of this supplement. The experiments, however, showed: that a higher percentage of mushrooms in the last month of picking was obtained with the addition of chemical substances (this is in agreement with the results with horse manure compost); that the mushroom mycelium maintained its vigorous and healthy condition during the whole [period of] culture, but that no total increase in yield directly due to the chemicals was detectable. In this respect too, pig manure is seen to be different from horse manure.

In all the experiments with pig manure, the techniques of cultivation and cropping, normally used for horse manure compost, was employed. The methods of watering and ventilation were the same. The work was done with only one spawn, B.B. Nos. 26 and 30. As casing, a sandy meadow soil, rich in humus and having a good structure, was used.

Conclusion

Pig manure is presumably a first-rate cultural medium for mushrooms. Further investigations will probably lead to still better results.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Reports from combine harvester operators indicate that straw was unusually tough and never before had there been so many belt replacements. Even fingers and knives on new machines had to be replaced after a couple of weeks' work. So it is just possible that a little more composting will be required during the winter months to get that degree of breakdown which is so necessary for a good compost.

As visitors to the international Conference at Copenhagen will recall, the heatwave had retarding effects on cropping on the Continent generally. No matter where we went, even though the visit had been arranged well in advance, we usually met with the same excuse " We can show you how we grow our mushrooms but regret that we cannot show you any mushrooms ". The heat had played havoc with the compost and mushrooms would just not develop.

All In the Air

In this connection it was interesting to note that most of the growers who had some mushrooms had stopped watering the beds, their arguments being that there was enough moisture in the air to meet the mushroom's requirements.

A Spanish grower present confirmed this and stated that it was common practice in the hotter parts of Southern Europe to stop watering beds in very hot weather. It is difficult for some growers to understand that hot air contains more moisture than cold air and very often their first impulse is to give more water when hot weather sets in. Then they soon begin to wonder why the top of the compost is getting soaked and forming an impervious wet layer which the mycelium cannot penetrate.

A direct and more serious result of the drought has been reported in the form of excessive concentrations of chlorine gas in mains water supplies especially in the more remote country areas. Apparently it is the practice to put a certain quantity of chlorine into reservoirs at regular periods. The operatives, however, forgetting that there was less and less water coming into the reservoirs, kept on adding the same quantities, and the concentration soon built up into dangerous proportions, so much so in some cases that it was having very harmful effects on crops.

There is one very outstanding instance of where a batch of compost was prepared and peak heated on a farm A and another grower B took a quantity of the trays and the appropriate amount of spawn and grew them on his own farm.

Grower B who had his own water supply, had a bumper crop, but A, on a mains supply, had a partial failure.

Twice as Much

In one case at least it was admitted by the engineer concerned that the chlorine concentration in the water was more than twice what it should have been. One American authority advises using chlorine at the rate of 1 part to 10,000 on the beds after casing, probably for the same reason that the casing itself is applied, that is to give the mushroom mycelium a somewhat unsuitable environment to encourage it to fructify.

Like most of these shock treatments, if overdone disaster will follow.

Any unusual upset in the normal weather conditions of a country, be it worse or better weather, can have repercussions and ramifications that are very hard to predict. The weather conditions generally in these islands are fairly well suited to mushroom growing, provided that is they stay as near as possible to the "mild, genial and salubrious" description of the old geography books.

Most writers on the subject of mushrooms nowadays prescribe greater efficiency but condemn greater production but surely the two go hand in hand. These apparent contradictions stemming from the same source are a common occurrence, like the two faces of an insurance company, for example, with the soft, sweet smiles and ingratiating tone of its salesmen as compared to the grim, harsh doubting atmosphere of its Claims Department.

All are agreed that greater production must be linked with increased publicity, but are they both progressing at the same speed? The grower is prepared to pay for the greater production but not always for the corresponding publicity.

Blinded by Desire

Like so many others he is so blinded by his desire to put a bit away for a rainy day that he would often be inclined to neglect the goose that lays the golden egg. Or is it that he just has not time to sort it all out in his mind? And any intelligent mushroom grower can become confused and frustrated at times.

There is usually one generally accepted way of growing any of the staple crops such as wheat and potatoes but there is no such straight and narrow path for the mushroom grower. The more books he reads and the more lectures and talks he attends, the more he finds just how broad and uncertain the path to success really is.

That is why I say once more: " If you have established a reasonably successful pattern for growing mushrooms be reluctant to make any very drastic changes ".

REPRINTS AVAILABLE

An important article by C. Riber Rasmussen, head of mushroom Research in Denmark, appears in this issue. It brings together a great deal of current information on the use of pig manure for mushroom growing.

Copies of this article, in booklet form, are available from the MGA Office, price 5/-.

A PROTEST

We all know that we can read good sense in *The Bulletin*. How strange your reprint from the *Fruit Trades' Journal* sounded. I do like robust and forthright argument ; but it must rely on good information.

The article contained little of this last requirement but much of a nasty sort of innuendo. It seems that only by voting for the levy could we escape being publicly asked whether we were mean or were not interested, to avoid having to give reasons for our decisions before a self-appointed criticiser, who would judge them and us ; and also enter the ranks of those who are not likely to give short weight.

If it seems fit to "The Retailer" and the *Fruit Trades' Journal* to print this sort of thing, then they must expect resentment because some MGA members' reputations have been smeared for no good reason. When men show different opinions in our Association, we do not publicly question the motives of those disagreeing with us, nor do we invite them to publicly stand trial. We ought not to allow others, outside the organisation, to do this either.

I would be glad if the Executive Council would ask for an apology for this irresponsible writing, doubly so because it is anonymous ; and to state publicly in the other paper that compulsion is abhorrent to many members, even to some who advise a greater contribution to publicity, and that there is no factual basis for suggesting that those who did not vote for the levy could be the ones who supply short weight.

E. PALFREY, (Harpenden).

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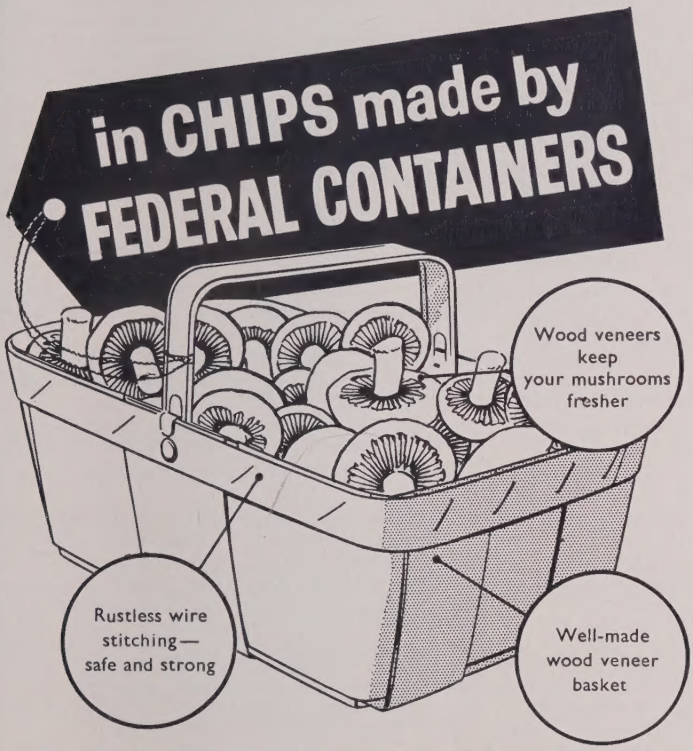
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